

CLAIMS

1. Portable control, program and/or teach terminal provided for the connection to a control unit (5) of movements according to multiple axes of an automatic  
 5 apparatus (1) bearing a tool (4), such as a robot or similar, the terminal (6) having a longitudinally extended body defining a first portion (10) and a second portion (11) comprising an area of union to the first portion (10), wherein in correspondence with a  
 10 front side of the first portion (10) a display device (D) is provided and in correspondence with a front side of the second portion (11) a multiplicity of keys is provided, said multiplicity comprising:

- a plurality of motion keys (14) able to be  
 15 operated manually to provide the control unit (5) with a respective command signal for the apparatus (1), the command signal being aimed at causing the tool (4) to execute a rotation or a translation motion about or along an axis corresponding to the operated motion key  
 20 (14),

- a plurality of teaching keys (15-24, 26), able to be operated manually for programming the control unit (5) and/or controlling the apparatus (1) and/or storing a position reached by a predefined point (TCP) of the  
 25 tool (4) as a result of a motion of the apparatus (1), characterised in that

- the second portion (11) of the body of the terminal (6) has a width which progressively decreases until reaching said area of union,

- at least one between said plurality of motion  
 30 keys (14) and said plurality of teaching keys (15-24, 26) comprises a first and a second series of keys (14) being positioned each along a respective longitudinal side of the second portion (11), preferably in a  
 35 substantially symmetrical fashion to each other, and

- the other between said plurality of motion keys (14) and said plurality of teaching keys (15-24, 26) comprises a group of keys (15-22, 26) being positioned within or close to said area of union.

5        2. Terminal as claimed in claim 1, characterised in that the first series consists of keys for controlling translation movements and the second series consists of keys for controlling rotation movements.

10       3. Terminal as claimed in claim 1, characterised in that the body comprises a rear part wherein a longitudinally extended recess (12) is defined, having two opposite longitudinal sides, each longitudinal side extending substantially parallel to a respective side surface of the second portion.

15       4. Terminal as claimed in claim 1, characterised in that the terminal (6) comprises a safety device of the "dead man" type (13) and that the body comprises a rear part wherein a longitudinally extended recess (12) is defined, from each of two opposite longitudinal sides  
20 of the recess (12) projecting towards the interior of the recess an elongated button (13), each elongated button (13) being part of the safety device.

5       5. Terminal as claimed in claim 1, characterised in that it comprises selection means (18), able to be  
25 operated manually to select a desired co-ordinate system among a plurality of co-ordinate systems ("Base, "Tool", "Joints") stored in the control unit (5), that the operation of the motion keys (14) depends on a selection made through the selection means (18) and  
30 that said command signal is aimed at causing the tool (4) to execute a rotation or a translation motion about or along an axis corresponding to the operated motion key (14), in the co-ordinate system ("Base, "Tool", "Joints") selected using the selection means (18).

35       6. Terminal as claimed in claim 5, characterised in

that it further comprises additional motion control means (40, 41), able to be operated manually instead of the motion control means (14), to provide the control unit (5) with a respective signal for controlling the apparatus (1) aimed at causing a displacement of the predefined point (TCP) of the tool (4) relative to a previously set reference point (CO), where

- the position of the reference point (CO) is capable of being modified,
- the terminal (6) comprises means (D; T) for modifying the position of the reference point (CO),
- the signal for controlling the apparatus (1) generated as a result of the operation of the additional motion control means (40, 41) is independent from the co-ordinate system ("Base", "Tool", "Joints") selected through the selection means (18)

7. Terminal as claimed in claim 6, characterised in that the additional motion control means (40, 41) are positioned in a central part of the second portion (11).

8. Terminal as claimed in claim 6, characterised in that the additional motion control means (40, 41) are positioned between the first and the second series of motion keys (14).

9. Terminal as claimed in claim 6, characterised in that the additional motion control means (40, 41) are able to be operated to cause Cartesian displacements of the predefined point of the tools (TCP) relative to the set reference point (CO).

10. Terminal as claimed in claim 6, characterised in that the additional motion control means (40, 41) can be operated to cause angular or rotary displacements about a respective axis of the predefined point of the tools (TCP).

11. Terminal as claimed in claim 6, characterised

in that the reference point (CO) is representative of the position of the terminal (6), and hence of a user (7) who supports it, relative to the apparatus (7).

12. Terminal as claimed in claim 2, characterised  
5 in that the additional motion control means (40, 41) can be operated to cause a displacement of the predefined point of the tool (TCP) closer, farther away, to the right, to the left, upwards or downwards relative to the position of the terminal (6), and hence  
10 of the user who supports it (7).

13. Terminal as claimed in claim 11, characterised in that the additional motion control means (40, 41) can be operated to cause a rotation of the predefined point of the tool (TCP) about a respective axis,  
15 counter-clockwise or clockwise to the right, counter-clockwise or clockwise towards the position of the terminal (6) and counter-clockwise or clockwise upwards.

14. Terminal as claimed in claim 11, characterised  
20 in that the additional motion control means (40, 41) comprise a compass knob (40) able to be selectively operated in four lateral areas thereof to cause, in one of its operating modes, a displacement of the predefined point of the tool (TCP) closer, farther  
25 away, to the right or the left relative to the position of the terminal (6).

15. Terminal as claimed in claim 11, characterised in that the additional motion control means (40, 41) comprise a dual pressure key (41), able to be operated  
30 selectively at its two end areas to cause, in an operating mode thereof, a displacement of the predefined point of the tool (TCP) upwards or downwards relative to the position of the terminal (6).

16. Terminal as claimed in claim 14, characterised  
35 in that the compass knob (40) can be selectively

operated in four lateral areas thereof to cause, in an additional operating mode, a displacement of the predefined point of the tool (TCP) about a respective axis, counter-clockwise and clockwise to the right and counter-clockwise and clockwise towards the position of the terminal (6).

17. Terminal as claimed in claim 15, characterised in that the dual pressure key (41) can be selectively operated at two end areas thereof to cause, in an additional operating mode, a rotation of the predefined point of the tool (TCP) about a respective axis, counter-clockwise or clockwise upwards.

18. Terminal as claimed in claim 6, characterised in that the means (D; T) for modifying the position of the reference point (CO) comprises an information input page capable of being displayed on the display device (D).

19. Terminal as claimed in claim 6, characterised in that the means (D; T) for modifying the position of the reference point (CO) comprise means for generating graphic information on the display device (D), the graphic information being representative of the position of the reference point (CO) relative to the robot (1).

20. Terminal as claimed in claim 19, characterised in that the means for generating graphic information comprise

- means for generating on the display (D) a first symbol (CO), representative of the reference point,
- means for generating on the display (D) a second symbol (PR), representative of the robot (1);
- means for moving the first symbol (CO) relative to the second symbol (RR) using the first key (20), in particular along a substantially circular trajectory (TC).

21. Terminal as claimed in claim 6, characterised in that the means (D; T) for modifying the position of the reference point (CO) are part of a system (T, R) for the automatic recognition of the angular position  
 5 of the terminal (6) relative to the apparatus (1).

22. Terminal as claimed in claim 21, characterised in that the automatic recognition system (T, R) comprises signal emitter means (T) and signal receiving means (R), the signal emitter means (T) being  
 10 operatively associated to one between the terminal (6) and the robot (1) and the signal receiver means (T) being operatively associated to the other between the terminal (6) and the apparatus (1).

23. Terminal as claimed in claim 1, characterised in that said group of keys comprises one or more keys  
 15 selected in the group consisting of:

- at least a key (15) for varying the translation velocity of the robot (1), positioned in particular in the right part of the second portion (11), towards the  
 20 centre thereof;

- a key (16) for starting a sequence of motions of the robot (1), positioned in particular in the right part of the second portion (11), towards the centre thereof;

- 25 - a key (17) for stopping a motion of the robot (1), positioned in particular in the right part of the second portion (11), towards the centre thereof;

- a key (18) for selecting a desired co-ordinate system among a plurality of co-ordinate systems,  
 30 positioned in particular in the left part of the second portion (11), towards the centre thereof;

- a repetition key (19), which, when pressed, causes the robot (1) to trace back one or more previously executed motions, positioned in particular  
 35 in the right part of the second portion (11), towards

the centre thereof;

- a key (26) for commanding the execution of individual steps of a previously set sequence of motions of the robot (1), positioned in particular in the right part of the second portion (11), towards the centre thereof;

- a plurality of programming keys (20-23) positioned in particular in the left part of the second portion (11) and comprising at least multiple cursor keys (20), a data recording key (21), a data modification key (22);

24. Terminal as claimed in claim 1, characterised in that in the first portion (10), laterally to the display device (D), are positioned one or more function keys (TF1, TF2, TF3).

25. Terminal as claimed in claim 1, characterised in that in correspondence with an end area of the first portion (11) are positioned a key selector (31) and a mushroom head safety push-button (32).